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ON SURFICIAL SEDIMENTS IN CENTRAL SOUTH CAROLINA - A PROGRESS REPORT

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ABSTRACT

During 1960 through 1962, investigation of near-surface sediments on the Coastal Plain of South Carolina has been carried out by means of drilled holes and surface mapping. A Miocene age has been indicated by W. K. Pooser for the "Orangeburg Scarp"; and the "Coharie Terrace", lying immediately to the east, is underlain by at least four possible stratigraphic units. The "Sunderland Terrace" is underlain by two stratigraphic unit types, marine sand and several fluvial sediment sequences. The "Wicomico Terrace" is underlain by a coarse-grained basal sand, which is overlain from northwest to southeast by a coarse sand, a central fine clayey sand, a fine well-sorted lenticular sand body, and a southeasternmost fine clayey sand. At least three units are recognized underlying the "Penholoway Terrace"—(1) a basal coarse-grained sand, (2) an overlying clayey sand which grades eastward to a blue-grey marl, and (3) overlying constructional features resembling a spit and bars. Cross-sectional and other drilling indicates that destructional subsurface scarps are associated with each of the surface scarps southeastward from and including the Surry Scarp and that subsurface terraces are associated with each of the surface terraces. An informal physiographic terminology is used to facilitate discussion.

INTRODUCTION

Since the latter part of 1960, surficial sediments within the central portion of the Coastal Plain of South Carolina have been investigated at irregular intervals with the support of the Division of Geology, South Carolina State Development Board. Some of the observations and conclusions have been reported (Colquhoun, 1961A, 1961B) (Colquhoun and Duncan, 1962). Since the work is of a continuing nature, a progress report is considered appropriate.

PURPOSE AND SCOPE

Except for the recently published Irmo, Ladson, and Fort Jackson North quadrangles (Heron and Johnson, 1958; Malde, 1959; and Pooser and Johnson, 1961, respectively) little detailed geological mapping is available for the Coastal Plain of South Carolina. In order to increase knowledge of the detailed geology of the Coastal Plain, the following projects have been undertaken.

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In the fall of 1960, the Division of Geology began drilling a large number of power auger holes along Interstate Route 1-26 between Columbia and Charleston (Figure 1). The program was enhanced by accurate elevation profiles constructed in the course of development of this road, and fresh roadcuts were available. A series of holes up to 95 feet in depth were drilled at four miles intervals to provide initial regional familiarity with the stratigraphic section. In areas where correlation became obscure, closer drilling and/or offset drilling was carried out. Samples were collected at five to ten foot intervals and processed for grain-size distribution, magnetically susceptible minerals, and microfossil content.

After completion of this portion of the project in the fall of 1961, detailed investigation of various areas along this map strip was commenced.

Contours depicting the top of the Cooper Marl in the Ladson Quadrangle, S. C., were prepared from published data (Malde, 1959), auger holes, and seismic determinations and were published in 1961 (Colquhoun, 1961B).

Secondly, detailed study was begun of the surficial sediments in the vicinity of the Eutawville 15 minute quadrangle, an area including the Wicomico and Sunderland terraces of Cooke (1936). Approximately 75 power auger holes were drilled at one to two mile intervals. Roadcuts, borrow pits, and the shoreline of Lake Marion were mapped in order to obtain structural information. Aerial photographs and topographic maps were consulted to coordinate data. The preliminary results of this investigation were reported at the Southeastern Section meeting of the Geological Society of America in April 1962, and that paper is at present being rewritten for publication.

A third area of detailed investigation lies near the City of Orangeburg, emphasis here being on the various sediments associated with a topographic scarp having a toe lying at an elevation of about 210' above sea level. This scarp, herein referred to informally as the "Orangeburg Scarp", has been termed the Citronelle Escarpment by Doering (1960). In this area, approximately 30 power auger holes have been drilled in the course of detailed mapping of the southeastern quarter of the St. Matthews 15 minute quadrangle.

A fourth area of investigation lies in the vicinity of the Blaney, Blythwood, Irmo Northeast, Columbia North, Messer's Pond, and Congaree 7½ minute quadrangles, South Carolina. The first three of these are presently being prepared for publication by the Division of Geology and were originally mapped by students of the Department of Geology, University of South Carolina, as partial fulfillment of the degree of Master of Science during the years from 1958 through 1962.

In addition to the above data, a large area in south central South Carolina has been the subject of a Doctoral Dissertation by W. K. Pooser at the University of Kansas, with particular attention being given to the micropaleontology and lithology of Tertiary formations.

PREVIOUS WORK

THE FOLLOWING NOTES ARE NOT MEANT TO BE AN EXHAUSTIVE TREATMENT OF A RATHER VOLUMINOUS LITERATURE ON THE COASTAL PLAIN BUT RATHER TO POINT OUT SOME OF THE MORE IMPORTANT CONTRIBUTIONS. ASIDE FROM DETAILED INVESTIGATIONS PREVIOUSLY NOTED, SEVERAL REGIONAL INVESTIGATIONS HAVE BEEN MADE IN SOUTH CAROLINA. C. W. COOKE'S 1936 MEMOIR IS PARTICULARLY WELL KNOWN AND THE MOST REGIONALLY DETAILED STUDY TO DATE. IN IT HE RECOGNIZED AND MAPPED A NUMBER OF FORMATIONS AND SURFACE TERRACES WHICH HE REGARDED AS PLEISTOCENE, FOLLOWING IN PART THE WORK OF SHATTUCK (1901, 1906), CLARKE (1915), WENTWORTH (1930), AND STEPHENSON (1912, 1926). WITHIN THE MAP AREA BEING STUDIED IN THIS REPORT, THE FOLLOWING TERRACES AS MAPPED BY COOKE (1936) ARE TRAVERSED:

TERRACE AND FORMATION	APPROXIMATE SHORELINE ELEVATION	AGE (COOKE, 1945)
BRANDYWINE	270'	AFTONIAN
COHARIE	215	
SUNDERLAND	170	YARMOUTH
WICOMICO	100	
PENHOLOWAY	70	SANGAMON
TALBOT	42	
PAMLICO	25	MID-WISCONSIN

COOKE THOUGHT THAT SEA LEVEL WAS PROGRESSIVELY LOWERED DURING THE PLEISTOCENE AND THAT THESE SHORELINES WERE SUCCESSIVELY CUT BY STANDS OF THE SEA DURING THE INTERGLACIAL STAGES. WHERE TWO SHORELINES WERE FORMED DURING ONE STAGE, THE HIGHER MARKED THE CULMINATION OF THE STAGE AND THE LOWER A PAUSE DURING REGRESSION OF THE SEA.

FLINT (1940) SERIOUSLY QUESTIONED SOME OF THESE INTERPRETATIONS, POINTING OUT TWO MAJOR TRANSGRESSIONS WHICH HE RECOGNIZED BY MAJOR SEAWARD FACING SCARPS. ONE OF THESE, THE SURRY SCARP (WENTWORTH, 1930), HE WAS ABLE TO CORRELATE DISCONTINUOUSLY FROM VIRGINIA AS FAR SOUTH AS THE SAVANNAH RIVER. THE SCARP MARKS THE DIVISION BETWEEN COOKE'S MAPPED WICOMICO AND SUNDERLAND TERRACES. FLINT'S RECONNAISSANCE OF THE SOILS ASSOCIATED WITH THIS SCARP LED HIM TO CONCLUDE THAT COARSER-GRAINED SEDIMENTS AT THE TOE IN SEVERAL AREAS MIGHT SUGGEST A BEACH. IN ADDITION HE RECOGNIZED A NUMBER OF FEATURES SUGGESTIVE OF BARS AND OTHER CONSTRUCTIONAL FEATURES LYING TO THE EAST, AND FLUVIAL OUTWASH SEDIMENTS LYING TO THE WEST NEAR MAJOR RIVERS. IDENTIFICATION BY HYYPPA OF MARINE DIATOMS FROM AN ELEVATION OF APPROXIMATELY 70 FEET WAS NOTED IN THE SAME REPORT. THESE CAME FROM SEDIMENTS ASSOCIATED WITH COOKE'S PENHOLOWAY TERRACE.

RICHARDS (1943) IDENTIFIED A NUMBER OF MEGAFOSSIL SPECIES FOUND DURING THE DEVELOPMENT OF THE SANTEE-COOPER HYDROELECTRIC PROJECT. HE NOTED TWO FACIES PRESENT IN THE SECTION, A LOWER COARSER-GRAINED SAND AND AN UPPER FINE-GRAINED CLAYEY SAND, AND ASCRIBED THEM TO SEDIMENTS DEPOSITED BY THE TRANSGRESSION WHICH HAD DEPOSITED THE "PENHOLOWAY FORMATION" OR THAT WHICH HAD CUT THE SURRY SCARP. LATER (1950) HE STATED A LATE

PLIOCENE OR EARLY PLEISTOCENE AGE WAS POSSIBLE FOR THESE SPECIES.

DOERING (1958) INTERPRETED A CROSS-SECTION THROUGH CENTRAL SOUTH CAROLINA INDICATING A SERIES OF LAGOONS AND EXTRACOASTAL FEATURES FOR EACH OF COOKE'S MAPPED TERRACES BELOW THE SURRY SCARP.

DU BAR (1959) SUGGESTED THE POSSIBILITY THAT A RELATIONSHIP BETWEEN WACCAMAW AND "WICOMICO" SEDIMENTS MIGHT BE PRESENT, AND THAT THE FORMER COULD POSSIBLY BE PLEISTOCENE IN AGE RATHER THAN PLIOCENE.

MALDE (1959) IN A STUDY OF THE LADSON QUADRANGLE, SOUTH CAROLINA, MAPPED ASSOCIATED SURFICIAL SEDIMENTS IN DETAIL AND FORMALLY INTRODUCED THE TERM LADSON FORMATION. HE THOUGHT SEDIMENTS UNDERLYING THE "TALBOT TERRACE" MIGHT UNDERLIE THE "PENHOLOWAY TERRACE" AND SUGGESTED THE REASON FOR SOME TERRACE DEVELOPMENT MIGHT INVOLVE EROSION ON DIFFERING LITHIC TYPES. HE THOUGHT THE TRANSGRESSION RESPONSIBLE FOR THESE SEDIMENTS MIGHT HAVE RISEN TO POSSIBLY 100 FEET ABOVE PRESENT SEA LEVEL. IN ADDITION HE MAPPED THE WESTERN LIMIT OF THE "PAMLICO FORMATION" IN THE AREA WHICH HE THOUGHT WAS THE EQUIVALENT OF THE "SUFFOLK SCARP" (WENTWORTH, 1930, P. 57) CORRELATING NORTHWARDS.

RICHARDS AND HOPKINS (1960) IDENTIFIED A NUMBER OF REWORKED OLIGOCENE MEGAFOSSIL SPECIES COLLECTED FROM PHOSPHATE ROCK NEAR CHARLESTON, THE LATTER OCCURRING IN THE LOWER PORTION OF THE "LADSON FORMATION".

DOERING (1960) IN A STUDY OF THE SURFICIAL SEDIMENTS OF THE ATLANTIC AND GULF COASTAL PLAINS, CORRELATED THE "CITRONELLE FORMATION" INTO SOUTH CAROLINA AND TERMED THE SCARP HAVING A TOE LYING AT APPROXIMATELY 210 FEET NEAR ORANGEBURG THE "CITRONELLE ESCARPMENT". HE COULD NOT DISTINGUISH BETWEEN COOKE'S BRANDYWINE, COHARIE, AND SUNDERLAND TERRACES AND MAPPED THEM AS THE "SUNDERLAND FORMATION", ASCRIBING THE SEDIMENTS TO A COALESCENCE OF ALLUVIAL FANS FORMED BY STREAMS ISSUING THROUGH THE "CITRONELLE ESCARPMENT". BELOW THE SURRY SCARP HE MAPPED A NUMBER OF SHORELINES AND EXTRACOASTAL FEATURES FOLLOWING IN GENERAL THE TERMINOLOGY USED BY COOKE (1936) BUT ASSIGNING SOMEWHAT DIFFERENT TIME RELATIONSHIPS.

DU BAR (1962B) HAS RECENTLY PUBLISHED FAUNAL LISTS FROM WACCAMAW AND CROATAN DEPOSITS IN THE CAROLINAS.

AS SIPLE (1957) AND DU BAR (1959) HAVE POINTED OUT, MUCH MORE WORK NEEDS TO BE DONE IN SOUTH CAROLINA BEFORE COMPLETE UNDERSTANDING OF PLIOCENE AND PLEISTOCENE STRATIGRAPHY IS REACHED.

TERMINOLOGY

Within central South Carolina little actual published data concerning the nature of surficial sediments is available, primarily because of a general lack of outcrops. Many of the sediments are almost entirely unconsolidated to the point that even structures disclosed in roadcuts are frequently transitory features. Malde's (1959) approach of drilled holes provides the only really close-spaced data. Soil surveys do not penetrate sufficient section to give more than general information; and the soil profile, as well as thin colluvium, tends to mask underlying Coastal Plain geology, particularly in the case of the higher terraces. Aerial photographs are extremely useful in delineating regional extent of surficial sediments examined in the field and frequently show features not apparent on the ground. Direct interpretation from topographic maps is useful but can lead to questionable results as White (1958) has indicated.

These studies are primarily based on data obtained from power auger holes supplemented by examination of sparse outcrops, aerial photographs, accurate highway profiles, and topographic maps. The equipment and drilling procedure has been outlined by Smith (1961). Because of the nature of the power auger, samples obtained usually do not retain sedimentary structures and in certain cases can be highly contaminated. Nevertheless, by careful drilling technique involving constant attention to drilling pressure and rate, reasonably reliable samples have been obtained which yield significant correlatable results when subjected to common sedimentary analysis procedures.

Two general terminologies have been introduced in South Carolina, one based on terraces (Cooke, 1936) and the other on scarps (Flint, 1940). Each is based primarily on topographic expression, though geomorphic considerations and some sedimentary petrologic descriptions have been involved.

Cooke (1936) indicated seven major terraces, each of which he thought was underlain by a separate and distinct formation. From highest (oldest) to lowest (youngest) these were the Brandywine, Coharie, Sunderland, Wicomico, Penholoway, Talbot, and Pamlico terraces.

Flint (1940) in mapping surface scarps southward from Virginia was able to recognize only two such features — (1) the Surry Scarp, separating the "Sunderland" and "Wicomico" terraces, and (2) the Suffolk Scarp, generally recognized as defining the inland edge of the "Pamlico" terrace. He traced the Surry Scarp to the Savannah River but did not locate the Suffolk Scarp in South Carolina.

Malde (1959, p. 60) implied the correlation of the Suffolk Scarp with the slope that descends seaward from Ten-mile in Charleston County but questioned the stratigraphic differentiation between the "Penholoway" and "Talbot" formations, suggesting that flat surfaces in the respective "terrace"

AREAS RESULTED FROM EROSION ON DIFFERENT LITHIC TYPES AND THAT SEDIMENTS UNDERLYING THE "TALBOT" TERRACE MAY UNDERLIE THE "PENHOLOWAY" TERRACE AS WELL.

DOERING (1960) COULD NOT DIFFERENTIATE BETWEEN THE "BRANDYWINE", "COHARIE", AND "SUNDERLAND" TERRACES. HE SUGGESTED THAT SURFICIAL SEDIMENTS PRESENT IN THESE RESPECTIVE "TERRACE" AREAS COULD HAVE BEEN DEPOSITED BY COALESCING ALLUVIAL FANS ISSUING FROM A HIGHLAND WHICH TERMINATES ABRUPTLY AT A SCARP READILY APPARENT NEAR ORANGEBURG. DOERING TERMED THIS PHYSIOGRAPHIC FEATURE THE "CITRONELLE ESCARPMENT".

BECAUSE OF THE SOMEWHAT JUMBLED NATURE OF THE NOMENCLATURE, THE VARIOUS "FORMATIONS", "TERRACES", AND "SCARPS" WILL BE TREATED IN THE REMARKS TO FOLLOW IN A PROVISIONAL SENSE ONLY. NO EQUIVALENCE OR GENETIC RELATIONSHIP BETWEEN ANY PHYSIOGRAPHIC FEATURE AND ANY LITHOLOGIC UNIT IS IMPLIED. THE PRESENT STUDY IS NOT COMPLETE, AND THERE IS AT THIS TIME NO INTENT TO ESTABLISH ANY FORMAL STRATIGRAPHIC NOMENCLATURE. THE FACIES AND UNIT TERMINOLOGY ILLUSTRATED IN FIGURE 3 IS UTILIZED ONLY TO ALLOW DISCUSSION OF LITHOLOGIC UNITS DEFINED BY DRILLING TO DATE. FEATURES DEVELOPED AT GROUND SURFACE ARE PREFIXED BY THE TERM "SURFACE" (E.G., "SUNDERLAND" SURFACE TERRACE). FEATURES DEVELOPED IN THE SUBSURFACE ARE PREFIXED BY THE TERM "SUBSURFACE" (E.G., SURRY SUBSURFACE SCARP). FIGURE 3A ILLUSTRATES VISUALLY THE VARIOUS TERMS EMPLOYED. THE TERMS "ORANGEBURG SCARP", DORCHESTER SCARP", AND "SUMMERVILLE SCARP" (FIGURE 1) ARE PRESENTED INFORMALLY IN THIS STUDY FOR THE PURPOSE OF DISCUSSION.

OBSERVATIONS AND CONCLUSIONS APPLY ONLY TO THE AREA IN THE VICINITY OF ROUTE I-26 AS INDICATED ON FIGURE 1 AND ARE NOT MEANT TO BE APPLIED OUTSIDE OF THIS AREA PENDING FURTHER DRILLING.

OBSERVATIONS

Post Middle Eocene Sediments

SEDIMENTS OVERLYING ERODED MIDDLE EOCENE ROCKS HAVE BEEN OBSERVED ADJACENT TO AND NORTHWEST OF THE "ORANGEBURG SCARP" (CITRONELLE ESCARPMENT OF DOERING, 1960) (FIGURE 1) IN DRILLED HOLES AND SURFACE MAPPING. SIMILIAR SEDIMENTS HAVE BEEN LOCALLY DRILLED IN THE CONGAREE QUADRANGLE AND MAPPED BY GENERAL RECONNAISSANCE IN THE MESSER'S POND AND CONGAREE QUADRANGES NEAR COLUMBIA. SOME OF THESE LIE IN AREAS INDICATED BY DOERING (1960) AS CONTAINING THE CITRONELLE FORMATION (MATSON, 1916).

THE SEDIMENTARY SECTION LYING NORTHWEST OF THE "ORANGEBURG SCARP" IN CENTRAL SOUTH CAROLINA IS EXTENSIVELY WEATHERED. FOSSIL LOCALITIES ARE COMMONLY FOUND AT LOWER ELEVATIONS ALONG THE MAJOR VALLEYS. THE INTERFLUVES THEMSELVES, WHEN DRILLED, FREQUENTLY SHOW A VERY THICK WEATHERING PROFILE WHICH MAY BE AS MUCH AS FIFTY FEET THICK. IN ADDITION, A THIN MANTLE OF

COLLUVIUM, AS WELL AS THE SOIL PROFILE, TENDS TO MASK SEDIMENTARY CONTACTS SO THAT SURFACE MAPPING WITHOUT COMPLEMENTARY HAND OR POWER AUGER HOLES IS VERY DIFFICULT. SEDIMENTARY ANALYSES OF SAMPLES FROM DRILLED HOLES ARE SUFFICIENTLY DIFFERENT TO ENABLE IDENTIFICATION OF MOST OF THE MAJOR MAPPED SEDIMENTARY UNITS AS WELL AS MORE LOCAL UNITS, EVEN THOUGH THESE UNITS MAY BE EXTENSIVELY WEATHERED.

ONE THIN AND DISCONTINUOUS SEDIMENTARY UNIT OVERLYING MIDDLE EOCENE STRATA (FIG. 3A) HAS BEEN ENCOUNTERED. IT OCCURS NORTHWEST OF THE "ORANGEBURG SCARP" AND IS GENERALLY NOTED IN PLACE ONLY NEAR THE TOPS OF THE HIGHER HILLS IN INTERFLUVE AREAS. THE CHANNELLING NATURE OF THIS UNIT CAN BE DEMONSTRATED AT SEVERAL LOCALITIES WHERE IT CUTS INTO SUBJACENT STRATA. IT IS COMPOSED OF FINE TO COARSE SAND AND GRAVEL, OCCASSIONALLY WITH A CLAY MATRIX. THE SANDS ARE ANGULAR, THE GRAVELS SUBROUNDED TO ROUNDED AND SUBSPHERICAL. MINERALOGICALLY, QUARTZ IS THE MOST ABUNDANT CONSTITUENT OF THE PEBBLE FRACTION, BUT IGNEOUS AND METAMORPHIC LITHIC PEBBLES HAVE BEEN NOTED. SEDIMENTARY STRUCTURES ARE ABUNDANT, SCOUR AND FILL AND TORRENTIAL CROSS-BEDDING BEING MOST COMMON. ALONG INTERSTATE ROUTE I-26 THE UNIT IS EXPOSED NEAR THE TOP AND NORTHWEST OF THE "ORANGEBURG SCARP". HERE IN TWO ROAD-CUT EXPOSURES, WELL-ROUNDED, SUBSPHERICAL TO NEARLY SPHERICAL QUARTZ GRAVEL HAS BEEN NOTED COMMONLY ENCLOSED IN A CLAY MATRIX. RELIC CROSS-BEDDING CAN BE NOTED WITHIN THE LATTER. FREQUENTLY AT THIS AND OTHER LOCALITIES THE GRAVEL FRACTION SHOWS SIGNS OF INTENSE WEATHERING, OFTEN BREAKING EASILY TO A SUGARY TEXTURED SAND.

"COHARIE TERRACE"

IN ADDITION TO THE "BRANDYWINE", COOKE (1936) MAPPED TWO "TERRACES" NORTHWEST OF THE SURRY SCARP; THE "COHARIE" (215-170') AND THE "SUNDERLAND" (170-100'). DOERING (1960) DISAGREEING WITH THE SURFICIAL INTERPRETATION OF THE SEDIMENTS, MAPPED THESE TOGETHER. WITHIN THE LIMITS OF THESE "TERRACES" IN SOUTH CAROLINA, TWO AREAS HAVE BEEN STUDIED IN DETAIL THROUGH DRILLING — THE NORTHWESTERN AREA INCLUDING THE "BRANDYWINE" AND "COHARIE" TERRACES IN THE VICINITY OF THE "ORANGEBURG SCARP", AND A SOUTHEASTERN AREA INCLUDING THE "SUNDERLAND", "WICOMICO", AND "PENHOLOWAY" TERRACES IN THE VICINITY OF THE SURRY SCARP. BETWEEN THESE TWO AREAS, ONLY REGIONAL CROSS-SECTIONAL RECONNAISSANCE DRILLING HAS BEEN CONDUCTED; AND RESULTS ARE NOT CONCLUSIVE ENOUGH TO WARRENT REJECTION OF THE "COHARIE" IN A STRATIGRAPHIC SENSE NOR EXTENSION OF THE "SUNDERLAND" TO INCLUDE IT. (SEE FIGURE 1).

FOUR LITHOLOGIC UNITS HAVE BEEN MAPPED BY MEANS OF DRILLED HOLES IN THE NORTHWESTERN REGION, AND MAY BE CORRELATED AS IN FIGURE 2 AND INTERPRETED AS IN FIGURE 3A. NONE OF THESE CAN BE CORRELATED WITH STRATA OCCURRING NORTHWEST OF THE "ORANGEBURG SCARP."

THE SUBCROP OF THE "ORANGEBURG" SURFACE AND SUBSURFACE SCARP (THE "COHARIE" SUBSURFACE TERRACE IN PART), AND UNIT 1 (FIG. 3A, "COHARIE" UNIT 1) OF THE SUPRAJACENT SEDIMENT COM-

PLEX HAVE BEEN MAPPED BY W. K. POOSER DURING INVESTIGATIONS OF TERTIARY SEDIMENTS IN CENTRAL SOUTH CAROLINA, AND SOME OF THE ASSOCIATED SECTIONS AND DRILLED HOLES ARE ON OPEN FILE AT THE DIVISION OF GEOLOGY, SOUTH CAROLINA STATE DEVELOPMENT BOARD. DETAILED DRILLING IN THE SOUTHEAST QUARTER OF THE ST. MATTHEWS QUADRANGLE BY W. K. POOSER, H. S. JOHNSON, JR., P. BERNAT, AND THE AUTHOR HAVE CONFIRMED POOSER'S ORIGINAL MAPPING AND CARRIED HIS SURFACE AND AUGER HOLE DETERMINATIONS DIRECTLY TO THE TOE OF THE "ORANGEBURG" SUBSURFACE SCARP ITSELF.

"COHARIE" UNIT 1 (FIG. 3A) CONSISTS OF DARK BROWNISH GRAY, VERY CLAYEY, CALCAREOUS FINE SAND WHICH IS MODERATELY FOSSILIFEROUS. POOSER (1961, PERSONAL COMMUNICATION) HAS DATED THIS UNIT AS LATE MIOCENE.

ABOVE "COHARIE" UNIT 1 AT LEAST THREE LITHOLOGIC COMPLEXES CAN BE MAPPED. THE LOWERMOST, "COHARIE" UNIT 2 (FIGURE 3A), HAS NOT BEEN NOTED EXTENSIVELY AT THE SURFACE DUE TO LACK OF OUTCROPS BUT FROM SEDIMENTARY ANALYSES REFLECTS MANY OF THE CHARACTERISTICS OF UNIT 1 WITH THE EXCEPTION OF A DECREASE IN SILT AND CLAY PERCENTAGE AND DEVELOPMENT OF A LIGHT GRAY TO GOLDEN YELLOW COLOR. IT MAY BE A WEATHERED PORTION OF THE SECTION AND DERIVED FROM UNIT 1. IT IS AN UNFOSSILIFEROUS, WELL-SORTED MOSTLY FINE-GRAINED SAND. IT HAS BEEN OBSERVED LOCALLY TO BE LAMINATED AND OCCASIONALLY TO HAVE SMALL SCALE CROSS-BEDDING.

"COHARIE" UNIT 3 IS A THIN ARENACEOUS CLAY BED, USUALLY LIGHT GREY TO WHITE IN COLOR. THE POSITION OF THE UNIT AS SHOWN ON FIGURE 2 IS THOUGHT TO BE FORTUITOUS SINCE IN OTHER HOLES IT IS VARIABLE IN ELEVATION AND DISCONTINUOUS IN DISTRIBUTION. BOTH THIN BEDDING AND INCIPIENT TORRENTIAL CROSS-BEDDING HAVE BEEN NOTED.

THE UPPERMOST UNIT, "COHARIE" UNIT 4 (FIG. 3A), HAS BEEN OBSERVED IN SEVERAL ROAD-CUTS ALONG I-26 AND ENCOUNTERED IN NUMEROUS DRILLED HOLES. THE UNIT GRADES FROM VERY COARSE-GRAINED SAND AND FINE GRAVEL AT THE BASE TO MEDIUM-GRAINED SAND TOWARD THE TOP. THE SAND GRAINS ARE USUALLY ANGULAR, THE PEBBLES AND GRANULES RARE, SUBROUNDED TO WELLROUNDED AND SUBSPHERICAL. TORRENTIAL CROSS-BEDDING AND SCOUR AND FILL STRUCTURES HAVE BEEN NOTED. THE UNIT CUTS INTO AND ERODES THE UNDERLYING UNITS.

"SUNDERLAND TERRACE"

UNDERLYING THE "SUNDERLAND TERRACE" SEVERAL SEDIMENTARY COMPLEXES ARE PRESENT OVERLYING THE SANTEE LIMESTONE (MIDDLE EOCENE). THE LOWER COMPLEX CONSISTS OF FINE-GRAINED WELL-SORTED LIGHT BUFF GOLDEN YELLOW AND, WHERE FOSSILIFEROUS, LIGHT BLUE GREY CALCAREOUS SAND (FIG. 3B, "SUNDERLAND" UNITS 1 AND 2). THE UNIT CAN BE READILY CORRELATED THROUGH SEDIMENTARY ANALYSES IN DRILLED HOLES AND FREQUENTLY IS NON-FOSSILIFEROUS, PROBABLY BECAUSE OF LEACHING. FOSSILS, WHERE PRESENT, ARE FOUND AS A HASH WITHIN THE SAND. W. K. POOSER (1961, PERSONAL COMMUNICA-

TION) HAS DATED THESE STRATA AS LATE MIOCENE ON FOSSIL EVIDENCE.

SEDIMENTS OVERLYING "SUNDERLAND" UNITS 1 AND 2 ARE THOUGHT TO BE LARGELY ALLUVIAL (FIG. 3B, "SUNDERLAND" UNIT 3). BY MEANS OF NUMEROUS DRILLED HOLES, CHANNELS OF AGGRADED STREAM COURSES, AS WELL AS POSSIBLE SHORELINE INLETS, HAVE BEEN MAPPED WHICH CUT INTO THE LOWER COMPLEX; AND THEIR PRESENCE HAS BEEN OBSERVED IN ROADCUTS ALONG I-26 AND ALONG THE SOUTHEASTERN SHORE OF LAKE MARION. SOME MAY BE OBSERVED ON AERIAL PHOTOGRAPHS. FACIES CHANGES ARE RAPID WITHIN THESE UNITS. MEDIUM AND SOME COARSE SAND IS PROBABLY MOST COMMON; BUT FINE SAND, SILT, AND CLAY IS ALSO PRESENT, PARTICULARLY TOWARD THE TOP OF THE UNIT. THE SANDS ARE ANGULAR, BUT WELL ROUNDED AND SUBSPHERICAL PEBBLES UP TO THREE-QUARTERS OF AN INCH IN DIAMETER HAVE BEEN OBSERVED. THE SEDIMENTS APPEAR GENERALLY LESS MATURE MINERALOGICALLY THAN THOSE OCCURRING UNDER THE "WICOMICO" AND LOWER TERRACES TO THE EAST OF THE SURRY SCARP. RELATIVELY FRESH FELDSPAR CLEAVAGE FRAGMENTS AND PEBBLES HAVE BEEN OBSERVED UP TO GRANULE SIZE IN DRILLED HOLES; BUT IN ROADCUTS AND LAKE CLIFFS THEY ARE USUALLY ALTERED TO KAOLIN. CLAY BALLS ARE RARE. THE SEDIMENTS VARY CONSIDERABLY IN CHARACTERISTICS WITHIN SHORT DISTANCES LATERALLY AS WELL AS VERTICALLY. SORTING IS USUALLY GOOD TO MODERATE; BIMODAL DISTRIBUTION IS COMMON IN THE DRILLED SAMPLES, POSSIBLY THROUGH MIXING. TORRENTIAL CROSS-BEDDING, SCOUR AND FILL, AND MANY LOCAL UNCONFORMITIES ARE PRESENT. BY MEANS OF DETAILED EXAMINATION OF SEDIMENTARY RELATIONSHIPS IN THE VICINITY OF HOLLY HILL SOME OF THESE CHANNELS CAN BE SHOWN TO ANTIDATE THE "WICOMICO" SEDIMENTS, AND SOME TO BE CONTEMPORANEOUS WITH THEM.

IN SUMMARY, WITHIN AREAS UNDERLYING THE "SUNDERLAND" AND "COHARIE" SURFACE TERRACES AS MAPPED BY COOKE (1936) OR THE "SUNDERLAND" SURFACE TERRACE AS MAPPED BY DOERING (1960), THE BASE OF THE SURFICIAL SEDIMENTS (FIG. 3A, "COHARIE" UNIT 4; FIG. 3B, "SUNDERLAND" UNIT 3) IS HIGHLY IRREGULAR REGIONALLY, AND LOCALLY CAN BE DEMONSTRATED TO BE CHANNELLED, POSSIBLY REFLECTING FLUVIAL EROSION AND DEPOSITION. THESE SEDIMENTS POSSIBLY ALSO REPRESENT IN PART A COALESCENCE OF ALLUVIAL FANS AS SUGGESTED BY DOERING (1960), AT LEAST IN THE UPPER PORTION OF THE "COHARIE TERRACE", AS WELL AS COLLUVIUM. CORRELATION OF THE OTHER UNITS IS AT PRESENT OBSCURE.

"WICOMICO TERRACE"

FROM THE SURRY SCARP (FIG. 1) TOWARD THE EAST A DISTINCT CHANGE HAS BEEN NOTED IN THE CONFIGURATION OF THE SURFICIAL SEDIMENT SUBCROP CONTOURS. CONTOURS CONSTRUCTED AT THE BASE OF THE VARIOUS SURFICIAL SEDIMENT COMPLEXES AND GENERALLY ON TOP OF THE COOPER MARL ARE MUCH MORE REGULAR AND EVENLY DISPOSED THAN NORTHWEST OF THE SCARP. IT IS THOUGHT THAT MARINE EROSION IS RESPONSIBLE — HAVING PLANED OFF "SUNDERLAND" CHANNEL SEDIMENTS, MUCH OF THE LATE MIOCENE, PART OF THE COOPER MARL, AND LOCALLY THE SANTEE LIMESTONE (FIG. 2). FOR EACH SOMEWHAT DISSECTED SURFACE SCARP SEPARATING THE VARIOUS TERRACES THERE IS A SUBSURFACE SCARP AS WELL. THE BASE OF THESE

SURFICIAL SEDIMENTS A SHORT DISTANCE EAST OF THE 100' SURFACE CONTOUR IS USUALLY THE COOPER MARL; AND BECAUSE OF THE LITHOLOGY OF THIS UNIT (SEE MALDE, 1959), THE CONTACT IS EASILY DETERMINED DURING DRILLING. WITHIN THE STUDY AREA, THE SURFICIAL SEDIMENTS ARE UP TO APPROXIMATELY 50 FEET IN THICKNESS. UNLIKE SURFICIAL SEDIMENTS TO THE WEST, THE SEDIMENTS UNDERLYING THE "WICOMICO TERRACE" ARE FLOORED BY A COARSE-GRAINED SAND FACIES (FIG. 3B, "WICOMICO" UNIT 1) WITHIN THIS AREA WHICH GRADES TO THE NORTHWEST INTO A GENERAL COARSE-GRAINED FACIES AT THE SURFACE. TOWARD THE SOUTHEAST, A HIGH SILT AND CLAY FACIES (FIG. 3B, "WICOMICO" UNIT 3) OCCURS BETWEEN THE COARSE-GRAINED FACIES AND AN EASTWARD LENTICULAR FINE-GRAINED WELL-SORTED SAND FACIES (FIG. 3B, "WICOMICO" UNIT 2) WHICH FURTHER EASTWARD GRADES TO A FINE CLAYEY SAND (FIG. 3B AND 3C, "WICOMICO" UNIT 4). THE TREND OF THESE FACIES LIES APPROXIMATELY PERPENDICULAR TO THE REGIONAL DIP RATHER THAN ALONG IT. CONTOURS DRAWN AT THE BASE OF THE COARSE SAND UNIT RAPIDLY DECREASE EASTWARD FROM ABOUT 100' ABOVE SEA LEVEL TO APPROXIMATELY 60' ABOVE SEA LEVEL, THE LATTER VALUE HOLDING UNTIL THE "DORCHESTER" SUBSURFACE SCARP IS REACHED (FIG. 2).

"PENHOLOWAY TERRACE"

APPROXIMATELY 14 HOLES HAVE BEEN DRILLED WITHIN THE MAP STRIP TO DETERMINE SEDIMENT RELATIONSHIPS UNDERLYING THE "PENHOLOWAY TERRACE", AND MUCH MORE DRILLING NEEDS TO BE DONE TO OUTLINE THE REGIONAL EXTENT OF THE VARIOUS FACIES. A POORLY TO MODERATELY WELL DEFINED SURFACE SCARP, HEREIN TERMED THE "DORCHESTER SCARP", CAN BE NOTED ON THE RIDGEVILLE AND SUMMERVILLE QUADRANGLE MAPS. THE "DORCHESTER" SUBSURFACE SCARP HAS BEEN DETERMINED TO EXIST ALONG TWO CROSS-SECTIONS LYING APPROXIMATELY 10 MILES APART, ONE ALONG HIGHWAY I-26 (FIG. 1) AND ONE ALONG HIGHWAY U. S. 176. THE SUBSURFACE ELEVATION OF THE COOPER MARL DROPS FROM APPROXIMATELY 60' ABOVE SEA LEVEL AT THE SOUTHEASTERN EDGE OF THE "WICOMICO" SUBSURFACE TERRACE TO APPROXIMATELY 40' IN THE WESTERN PORTION OF THE "PENHOLOWAY" SUBSURFACE TERRACE, AND THE LATTER VALUE VERY SLOWLY DECREASES TO ABOUT 30' ABOVE SEA LEVEL AT THE TOP OF THE "SUMMERVILLE" SUBSURFACE SCARP (FIGURE 2). ADJACENT TO THE "DORCHESTER" SUBSURFACE SCARP , A BASAL COARSE SAND UNIT (FIG. 3C, "PENHOLOWAY" UNIT 1) IS FOUND SIMILAR TO THAT UNDERLYING THE "WICOMICO TERRACE", AND IT APPEARS TO EXTEND SOME THREE MILES TO THE EAST FROM PRESENT DRILLING DATA (FIGURE 2). THIS UNIT IS OVERLAIN TOWARD THE WEST BY A RELATIVELY HOMOGENEOUS BLACK, FINE-GRAINED, ARGILLACEOUS TO VERY ARGILLACEOUS SILT AND SAND (FIG. 3C, "PENHOLOWAY" UNIT 2) WHICH APPEARS TO GRADE TOWARD THE EAST TO A FINE AND MEDIUM GRAINED SOMEWHAT LESS ARGILLACEOUS CALCAREOUS MARL WHICH BEARS ABUNDANT PELECYPODS AND FORAMINIFERA AND MORE RARELY GASTROPODS AND OSTRACODS. PRELIMINARY STUDIES BY G. E. SIPLE AND J. R. DU BAR (PERSONAL COMMUNICATION) ON THESE FOSSILS HAVE REVEALED A LATE MIOCENE OR PLIOCENE-PLEISTOCENE AFFINITY.

OVERLYING THE EASTERN MARL IS A FINE AND MEDIUM-GRAINED MODERATELY WELL-SORTED SAND COMPLEX (FIG. 3C, "PENHOLOWAY" UNIT 3) WHICH IS SURFICIALLY EXPRESSED AS A SPIT AND WAS SO IDENTI-

FIED BY COOKE (1936). SEVERAL OTHER RELATIVELY LINEAR SAND DEPOSITS OCCUR NORTHWEST OF THIS COMPLEX, BETWEEN IT AND THE "DORCHESTER" SURFACE SCARP, AND ARE SUPERFICIALLY EXPRESSED AS BARS AND LOW RIDGES. DRILLING DATA NOT BEING INTENSIVE IN THIS AREA, IT IS NOT KNOWN AS YET WHETHER THESE GEOMORPHICALLY IDENTIFIABLE STRUCTURES ARE PART OF THE SUBJACENT STRATA (FIG. 3C, "PENHOLOWAY" UNIT 2) AND CONTINUOUS WITH THEM, OR WERE DEPOSITED UPON THEM AS A SEPARATE UNIT. IT IS TO BE NOTED THAT THE BASE OF ONE OF THESE UNITS IS VERY CLOSE TO THAT OF THE "WICOMICO" SUBSURFACE TERRACE, WHICH COULD INDICATE THAT THE "WICOMICO" AND THESE UNITS ARE CLOSELY ALLIED. IT IS ALSO TO BE NOTED THAT GRAIN-SIZE ANALYSES CONDUCTED ON APPROXIMATELY 200 SURFACE AND SHALLOW HAND AUGER SAMPLES TAKEN FROM THE "WICOMICO" AND "PENHOLOWAY" TERRACES HAVE REVEALED LITTLE COARSENING ADJACENT TO THE "DORCHESTER" SURFACE SCARP ON THE "PENHOLOWAY TERRACE". THUS SEDIMENT RELATIONSHIPS UNDERLYING THE "PENHOLOWAY TERRACE" OFFER SEVERAL INTERESTING PROBLEMS FOR INTERPRETATION.

"TALBOT TERRACE"

FOR THE LADSON QUADRANGLE, MALDE (1959) HAS PUBLISHED A STUDY OF THE SURFICAL SEDIMENTS TO WHICH REFERENCE MAY BE MADE. THE "SUMMERVILLE" SUBSURFACE SCARP (FIG. 2) DROPS FROM A TOP ELEVATION OF APPROXIMATELY 30' TO A TOE ELEVATION OF 20' NEAR SUMMERVILLE AND HAS BEEN DETERMINED TO EXIST ALONG TWO CROSS-SECTIONS LYING ABOUT TEN MILES APART. ANOTHER SUBSURFACE SCARP LYING FURTHER TO THE SOUTHEAST, NEAR OTRANTO, HAS A TOP ELEVATION OF APPROXIMATELY 20' AND A TOE ELEVATION OF APPROXIMATELY 0-10' (COLQUHOUN, 1961B).

"PAMLICO TERRACE"

LITTLE WORK HAS BEEN DONE BY THE AUTHOR ON SEDIMENTS UNDERLYING THE "PAMLICO TERRACE". COMPILATION OF DATA FROM FOUR DIVISION OF GEOLOGY POWER AUGER HOLES AND FROM ABOUT 20 OTHER DRILL HOLES AND EXCAVATIONS — INFORMATION SUPPLIED BY THE STATE HIGHWAY DEPARTMENT, THE CHARLESTON DEVELOPMENT BOARD, AND THE U. S. GEOLOGICAL SURVEY — INDICATES THE PRESENCE OF A NORTHEASTWARD TRENDING SUBSURFACE SCARP NEAR NORTH CHARLESTON IN THE NORTH CHARLESTON AND FORT MOULTRIE QUADRANGLES. THE CREST OF THIS SCARP HAS AN ELEVATION OF ABOUT 0 TO 10' ABOVE SEA LEVEL, AND THE TOE IS AT AN ELEVATION OF ABOUT 30 TO 50' BELOW SEA LEVEL.

SUMMARY

THE DATA PRESENTLY AVAILABLE SUGGESTS THE FOLLOWING CONCLUSIONS:

(1) SEDIMENTS OVERLYING MIDDLE EOCENE STRATA WEST OF THE "ORANGEBURG SCARP" ARE APPARENTLY FLUVIAL. THEY HAVE BEEN

THOUGHT TO BE PLEISTOCENE; BUT IF POOSER'S DATING OF UPPER MIOCENE STRATA EAST OF THE "ORANGEBURG SCARP" BE ACCEPTED, THEN A POST-MIDDLE EOCENE, PRE-LATE MIOCENE AGE IS INDICATED. THESE SEDIMENTS ARE GENERALLY THIN AND DISCONTINUOUS AND ARE APPARENTLY MORE HIGHLY WEATHERED THAN SURFICIAL SEDIMENTS TO THE SOUTHEAST. THE SURFACE OF THE TERTIARY BEDS UNDERLYING THESE SEDIMENTS HAS PROVED IN ONE AREA THROUGH DRILLING TO BE IRREGULAR, AND IT IS THOUGHT THAT IT WILL PROVE TO BE SO GENERALLY. THESE SEDIMENTS CANNOT BE CORRELATED WITH SEDIMENTS EAST OF THE "ORANGEBURG SCARP".

(2) SURFICIAL SEDIMENTS UNDERLYING THE "SUNDERLAND" AND "COHARIE" TERRACES CONTAIN ALLUVIAL MATERIAL AS INDICATED BY MAPPED CHANNELS, OBSERVED STRUCTURES, MEASURED TEXTURES, AND POSSIBLY BY INDICATED MINERALOGICAL COMPOSITION. SEVERAL LOCAL BASE LEVELS ARE APPARENT. POOSER HAS INDICATED AN UPPER MIOCENE AGE FOR THE SEDIMENTS SHOWN AS "COHARIE" AND "SUNDERLAND" UNIT 1 ON FIG. 3A AND 3B. THE AGE OF THE OVERLYING UNITS MAY VARY FROM LATE MIOCENE TO PLIOCENE-PLEISTOCENE, BUT NO POSITIVE PROOF OF THE LATTER DATE HAS BEEN NOTED IN THIS AREA. IT IS INTERESTING TO NOTE THAT HACK (1955) WAS OF A SIMILAR OPINION IN A MARYLAND STUDY. THESE UNITS CANNOT BE CORRELATED GENERALLY WITH SEDIMENTS NORTHWEST OF THE "ORANGEBURG SCARP".

(3) SEDIMENTS UNDERLYING THE "WICOMICO TERRACE" ARE THOUGHT TO BE LARGELY MARINE BUT OTHER SHORELINE ENVIRONMENTS ARE APPARENT. CONTOURS DRAWN AT THE BASE OF THE SEDIMENT COMPLEX ARE MORE REGULAR AND EVEN, INDICATING THAT THE UNDERLYING STRATA WERE PLANED OFF PRIOR TO DEPOSITION OF "WICOMICO" SEDIMENTS. WITHIN THE STUDY AREA, THE SURRY SUBSURFACE SCARP DROPS WITH DECREASING GRADIENT FROM AN ELEVATION OF APPROXIMATELY 102' TO AN ELEVATION OF APPROXIMATELY 60' ABOVE SEA LEVEL. THE SURRY SURFACE SCARP DECREASES FROM ABOUT 110' TO APPROXIMATELY 85-90' ABOVE SEA LEVEL. FACIES WITHIN THE ASSOCIATED SEDIMENT COMPLEX INDICATE A BASAL COARSE-GRAINED SAND WHICH MAY BE IN PART TRANSGRESSIVE AND WHICH MERGES TOWARD THE NORTHWEST WITH A COARSE-GRAINED SURFICIAL FACIES THAT IS PROBABLY LITTORAL. TOWARD THE SOUTHEAST A GENTLY ROLLING TOPOGRAPHY LYING AT AN ELEVATION IN EXCESS OF 95' IS UNDERLAIN BY A LENTICULAR FINE-GRAINED WELL-SORTED SAND FACIES WHICH MAY REPRESENT A BARRIER ISLAND AND BAR. NORTHWESTWARD IS FOUND A HIGH SILT AND CLAY FACIES WHICH MAY POSSIBLY REPRESENT A LAGOON, WHILE EASTWARD OF THE BAR IS A HIGH SILT AND CLAY FACIES WHICH MAY REPRESENT A SHELF ENVIRONMENT. THESE UNITS CANNOT BE CORRELATED GENERALLY WITH THOSE UNDERLYING THE "SUNDERLAND" SURFACE TERRACE. THE AGE MAY BE PLIOCENE OR PLEISTOCENE.

(4) SEDIMENTS UNDERLYING THE "PENHOLOWAY TERRACE" ARE AS YET TOO LITTLE STUDIED FOR ANY POSITIVE CONCLUSIONS. A BASAL COARSE-GRAINED FACIES OVERLAIN BY CLAYEY FINE SAND IS PRESENT IN THE WEST. TOWARD THE EAST A LANDFORM RESEMBLING A SPIT IS UNDERLAIN BY FINE AND MEDIUM MODERATELY WELL SORTED SAND, AND THE LATTER LIES UPON A CALCAREOUS BLUE-GREY FINE SAND AND CLAY. IT CANNOT BE PROVED AS YET WHETHER ONE OR TWO TRANSGRESSIONS ARE INVOLVED. THE "DORCHESTER" SUBSURFACE SCARP AND

THE "PENHOLOWAY" SUBSURFACE TERRACE INCLINES FROM ABOUT 60' IN THE WEST TO ABOUT 30' ABOVE SEA LEVEL IN THE EAST. THE SUBSURFACE SCARP APPEARS DESTRUCTIONAL, ERODING A PORTION OF THE COOPER MARL; BUT OVERLYING CONSTRUCTIONAL FEATURES MAY BE RELATED TO SEDIMENTS OF THE "WICOMICO TERRACE". THE AGE OF THE EASTERN MARL ON PRELIMINARY DATA IS LATE MIOCENE, PLIOCENE OR EARLY PLEISTOCENE.

(5) THE "SUMMERVILLE" SUBSURFACE SCARP AND "TALBOT" SUBSURFACE TERRACE INCLINES FROM ABOUT 30' IN THE WEST TO ABOUT 20' ABOVE SEA LEVEL IN THE EAST.

(6) A SUBSURFACE SCARP IN THE VICINITY OF OTRANTO, BERKELEY COUNTY, HAS A CREST AT ABOUT 20' AND A TOE AT ABOUT 0-10' ABOVE SEA LEVEL.

(7) A SUBSURFACE SCARP IN THE VICINITY OF NORTH CHARLESTON HAS A CREST AT ABOUT 0-10' ABOVE SEA LEVEL AND A TOE AT ABOUT 30 TO 50' BELOW SEA LEVEL.

PROBLEMS

ASIDE FROM THE NEED FOR SUBSURFACE DATA WITHIN THE CENTRAL PORTION OF THE "COHARIE" AND "SUNDERLAND" TERRACES AND THE "PENHOLOWAY" AND"PAMLICO" TERRACES, WHICH IT IS HOPED WILL CLARIFY CORRELATIONS, SEVERAL PROBLEMS HAVE BEEN ENCOUNTERED WHICH ARE GERMANE TO A REGIONAL INTERPRETATION.

(1) THE EXACT HISTORY OF THE DEVELOPMENT OF THE SCARP NEAR ORANGEBURG, SOUTH CAROLINA, IS STILL NOT CLEAR. THE LITHOLOGY OF UNIT 1 (FIG. 3A) AT THE FOOT OF THE SCARP SUGGESTS DEPOSITION IN AN ENVIRONMENT OF LOWER ENERGY LEVEL THAN PROBABLY WAS RESPONSIBLE FOR THE REMOVAL OF APPROXIMATELY 150 FEET OF SECTION OVER SO LONG A DISTANCE. LITTORAL EQUIVALENTS OF THE COOPER MARL (BY LITHIC FACIES) HAVE NOT BEEN NOTED WITHIN THE MAP-AREA, EVEN THOUGH THE WESTERN MARGIN OF THE COOPER HAS BEEN STUDIED IN DETAIL. IT IS POSSIBLE THAT THE COOPER SEA WAS PARTIALLY RESPONSIBLE FOR EROSION OF SOME OF THE EOCENE STRATA AND THAT A MIOCENE ADVANCE PREVIOUS TO THE UPPER MIOCENE MAY ALSO HAVE BEEN PARTIALLY RESPONSIBLE. WHAT IS KNOWN FROM PRESENT DRILLING ALONG THE I-26 PROFILE IS THAT COARSE-GRAINED WELL-SORTED SANDS SIMILAR TO THOSE DEVELOPED NEAR THE BASE OF THE SURRY SCARP DO NOT OCCUR WITHIN FOUR MILES OF THE "ORANGEBURG SCARP".

(2) THE NATURE AND LATERAL EQUIVALENCE OF VARIOUS CHANNELLING SURFICIAL SEDIMENTS DEVELOPED ON THE "SUNDERLAND" AND "COHARIE" TERRACES INDICATE CHANGES IN MARINE DISPOSITION TOWARD THE EAST. THEY MAY BE OF IMPORTANCE IN UNDERSTANDING MARINE CONDITIONS TO THE EAST AND MAY INDICATE THE PREVIOUS EXISTENCE OF SUBSEQUENTLY ERODED MARINE STRATA. THE STRATIGRAPHIC DIVISION BETWEEN SEDIMENTS UNDERLYING THE "COHARIE" AND "SUNDERLAND" TERRACES HAS YET TO BE DETERMINED WITHIN THIS MAP-AREA AND NEEDS AMPLIFICATION.

(3) The erosional and depositional history of the "Dorchester Scarp" (surface and subsurface) and "Penholoway Terrace" is of major importance in interpretation of marine transgression in South Carolina.

(4) The relationship of the "Talbot" and "Penholoway" terrace sediments is of considerable importance. Malde (1959) in introducing the Ladson Formation implied that the sediments composing the "Talbot Terrace" underlie those present on the "Penholoway" and that the relatively flat areas within the Ladson Quadrangle can be explained through differences of erosion on differing lithic types. To the northwest, outside of his map area, the identification of the "Summerville" subsurface scarp may indicate a complex relationship; and more subsurface investigation is needed before his conclusions can be tested regionally.

(5) The subsurface scarps in the vicinity of Otranto and North Charleston need to be studied further to determine their regional significance.

SELECTED REFERENCES

Clarke, W. B., 1915, The Brandywine Formation of the Middle Atlantic Coastal Plain: Am. Jour. Sci., 4th ser., v. 40, pp. 499-506.

Colquhoun, D. J., 1961A, Wicomico shoreline in Orangeburg, Dorchester, and Berkeley Counties, S. C.: S. C. State Development Board, Div. of Geology, Geologic Notes, v. 5, no. 4, pp. 43-50.

_____, 1961B, Contours drawn on top of the Cooper Marl in the Ladson quadrangle, S. C.: S. C. State Development Board, Div. of Geology, MS-4.

Colquhoun, D. J., and Duncan, D. A., 1962, Pleistocene and pre-Pleistocene stratigraphy and sedimentary petrography in the vicinity of Holly Hill, South Carolina: in Program for Geo. Soc. Am. Southeastern Section meeting, Atlanta, Ga., 1962, p. 14. (Abstract)

Cooke, C. W., 1925, Physical geography of Georgia: Georgia Geol. Survey Bull. 42.

_____, 1931, Seven coastal terraces in the Southeastern States: Wash. Acad. Sci. Jour., v. 21, p. 503-513.

_____, 1936, Geology of the Coastal Plain of South Carolina: U. S. Geol. Survey Bull. 867.

_____, 1941, Two shore lines or seven?: Am. Jour. Sci. v. 239, no. 6, pp. 457-458.

_____, 1943, Geology of the Coastal Plain of Georgia: U. S. Geol. Survey Bull. 941.

_____, 1945, Geology of Florida: Florida Geol. Survey Bull. 29.

Cooke, C. W., Gardner, J. A., and Woodring, W. P., 1943, Correlation of the Cenozoic formations of the Atlantic and Gulf Coastal Plain and the Caribbean region: Geol. Soc. America Bull., v. 54, p. 1713-1723.

Cooke, C. W., and MacNeil, F. S., 1952, Tertiary stratigraphy of South Carolina: U. S. Geol. Survey Prof. Paper 243-B.

Doering, J. A., 1956, Review of Quaternary surface formations of Gulf Coast region : Bull. Am. Assoc. Petrol. Geol., v. 40, p. 1816-1862.

_____,1958, Citronelle age problem : Bull. Am. Assoc. Petrol. Geol., v. 42, pp. 764-786.

_____, 1960, Quaternary surface formations of southern part of Atlantic Coastal Plain: Journ. Geology, v. 68, no. 2, pp. 182-202.

Du Bar, Jules R., 1959, The Waccamaw and Croatan deposits of the Carolinas: S. C. State Development Board, Div. of Geology, Geologic Notes, v. 3, no. 6, pp. 1-9.

_____,1962A, New radiocarbon dates for the Pamlico Formation of South Carolina and their stratigraphic significance: S. C. State Development Board, Div. of Geology, Geologic Notes, v. 6, no. 2, pp. 21-24.

_____, 1962B, Check list of Waccamaw and Croatan (Pliocene?) macrofossils of North and South Carolina: S. C. State Development Board, Div. of Geology, Geologic Notes, v. 6, no. 3, pp. 25-41.

Du Bar, Jules R., Chaplin, J. R., and Solliday, J. R., 1962, Paleoecology of the Pamlico deposits (Late Pleistocene) of Horry County, South Carolina: (Abstract); Program Ann. Mtg. Am. Assoc. Petrol. Geologists, vol. 46, no. 2, p. 264.

Flint, R. F., 1940, Pleistocene features of the Atlantic Coastal Plain: Am. Jour. Sc., vol. 238, no. 11, pp. 757-787.

_____,1942, Atlantic coastal "terraces": Washington Acad. Sci. Jour., vol. 32, no. 8, pp. 235-237.

_____, 1947, Glacial geology and the Pleistocene epoch, New York, John Wiley & Sons.

_____, 1955, Rates of advance and retreat of the margin of the late-Wisconsin ice front: Am. Jour. Sci., v. 253, pp. 249-255.

Flint, R. F., and Deevey, E. S., Jr. 1951, Radiocarbon dating of late-Pleistocene events: Am. Jour. Sci., v. 249, pp. 257-300.

Hack, J. T., 1955, Geology of the Brandywine area and origin of the upland of southern Maryland: U. S. Geol. Survey Prof. Paper 267-A.

Latimer, W. J., Snyder, J. M., and Van Duyne, Cornelius, 1917, Soil survey of Dorchester County, S. C.: U. S. Dept. Agriculture, Bur. Soils, advance sheets-field operations, 1915.

Latimer, W. J., Hutton, F. Z., Lounsbury, Clarence, Meyer, A. H., and Carr, M. E., 1918, Soil survey of Berkeley County, S. C.: U. S. Dept. Agriculture, Bur. Soils, advance sheets - field operations, 1916.

MacNeil, F. S., 1949, Pleistocene shorelines in Florida and Georgia: U. S. Geol. Survey Prof. Paper 221-F.

Malde, H. E., 1959, Geology of the Charleston phosphate area, South Carolina: U. S. Geol. Survey Bull. 1079.

MARTENS, J. H. C., 1935, BEACH SANDS BETWEEN CHARLESTON, S. C., AND MIAMI, FLA.: GEOL. SOC. AMERICA BULL., V. 46, P. 1563-1596.

MATSON, G. G., 1916, THE PLIOCENE CITRONELLE FORMATION OF THE GULF COASTAL PLAIN: U. S. GEOL. SURVEY PROF. PAPER 98-L, PP. 167-192.

PETTY, J. J., 1950, BIBLIOGRAPHY OF THE GEOLOGY OF THE STATE OF SOUTH CAROLINA: UNIV. SOUTH CAROLINA PUBS., PHYSICAL SCIENCES, 2D SER., BULL. 1.

RICHARDS, H. G., 1943, PLIOCENE AND PLEISTOCENE MOLLUSKS FROM THE SANTEE-COOPER AREA, SOUTH CAROLINA: ACAD. NAT. SCI. PHILADELPHIA, NOTULAE, NO. 118.

_____, 1945, SUBSURFACE STRATIGRAPHY OF ATLANTIC COASTAL PLAIN BETWEEN NEW JERSEY AND GEORGIA: AM. ASSOC. PETROL. GEOLOGISTS BULL., V. 29, P. 885-955.

_____, 1950, GEOLOGY OF THE COASTAL PLAIN OF NORTH CAROLINA: AM. PHILOS. SOC. TRANS., V. 40, PT. 1.

_____, 1959, RECENT STUDIES OF THE PLEISTOCENE OF THE SOUTH ATLANTIC COASTAL PLAIN: SOUTHEASTERN GEOLOGY, VOL. 1, NO. 1, PP. 11-21.

_____,1962 STUDIES ON THE MARINE PLEISTOCENE: AM. PHILOS. SOC. TRANS. V. 52, PT. 3.

RICHARDS, H. G., AND HOPKINS, A. H., 1960, OLIGOCENE FOSSILS FROM THE OLD BOLTON PHOSPHATE MINE NEAR CHARLESTON, S. C.: S. C. STATE DEVELOPMENT BOARD, DIVISION OF GEOLOGY, GEOLOGIC NOTES, V. 4, NO. 3, PP. 14-24.

ROY, C. J., 1939, TYPE LOCALITY OF THE CITRONELLE FORMATION, CITRONELLE, ALA.: AM. ASSOC. PETROLEUM GEOLOGISTS BULL. V. 23, NO. 10, PP. 1553-1559.

SHATTUCK, G. B., 1901, THE PLEISTOCENE PROBLEM OF THE NORTH ATLANTIC COASTAL PLAIN: JOHNS HOPKINS UNIV. CIRCULAR, V. 20, NO. 152, PP. 69-75 (REPRINTED IN AM. GEOLOGIST, V. 28, PP. 87-107).

_____, 1906, THE PLIOCENE AND PLEISTOCENE DEPOSITS OF MARYLAND: MARYLAND GEOL. SURVEY, PLIOCENE AND PLEISTOCENE, PP. 21-137.

SIPLE, G. E., 1957, GUIDEBOOK FOR THE SOUTH CAROLINA COASTAL PLAIN FIELD TRIP OF THE CAROLINA GEOLOGICAL SOCIETY, NOV. 16-17, 1957: S.C. STATE DEVELOPMENT BOARD, DIV. OF GEOLOGY, BULL. 24 (1959).

SMITH, L. N., 1961, THE POWER AUGER AS A GEOLOGIC TOOL IN THE COASTAL PLAIN OF S. C.: S. C. STATE DEVELOPMENT BOARD, DIV. OF GEOLOGY, GEOL. NOTES, V. 5, NO. 1.

STRINGFIELD, V. T., AND LAMOREAUX, P. E., 1957, AGE OF THE CITRONELLE FORMATION IN GULF COASTAL PLAIN: AM. ASSOC. PETROLEUM GEOLOGISTS BULL., V. 41, P. 742-746.

STEPHENSON, L. W., 1912, GEOLOGY OF THE COASTAL PLAIN OF NORTH CAROLINA: NORTH CAROLINA GEOL. AND ECON. SURVEY, V. 3.

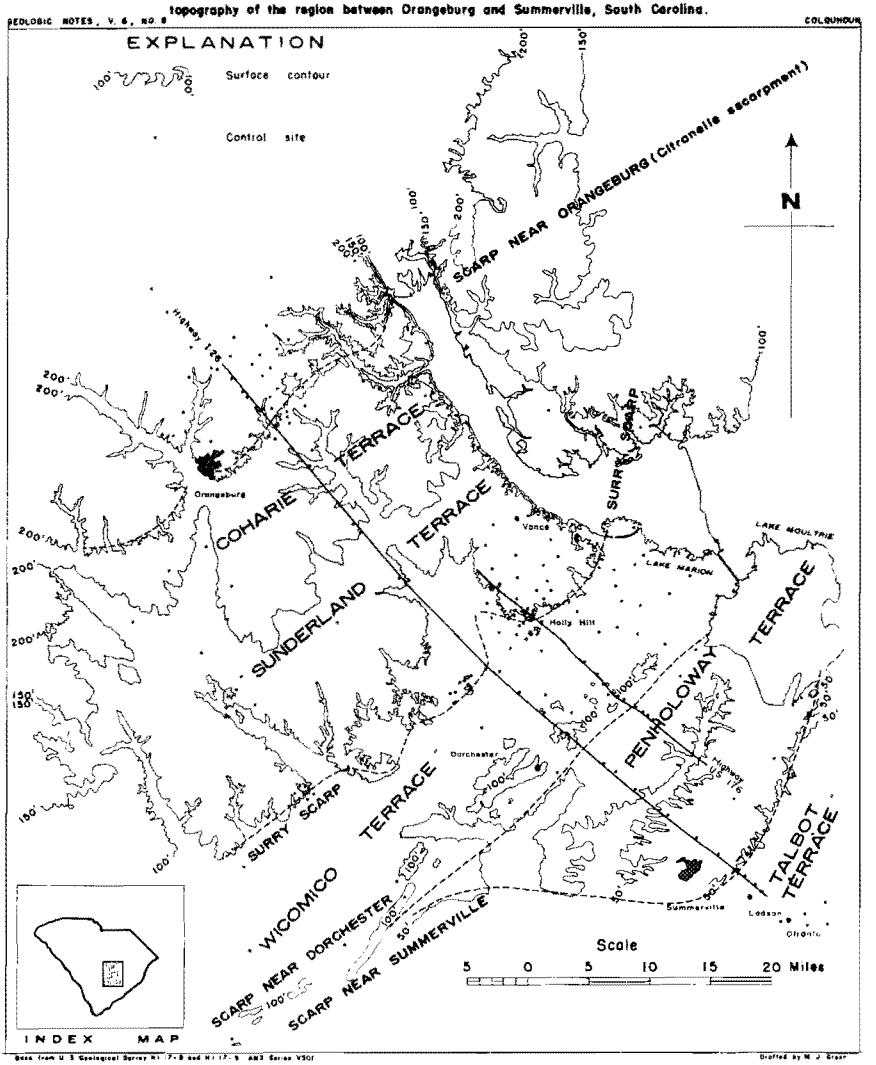
_____, 1926, MAJOR FEATURES IN THE GEOLOGY OF THE ATLANTIC AND GULF COASTAL PLAIN: WASH. ACAD. SCI., JOUR., V. 16, PP. 460-480.

VEATCH, J. O., STEPHENSON, L. W., 1911, GEOLOGY OF THE COASTAL PLAIN OF GEORGIA: GEORGIA GEOL. SURVEY BULL. 26.

WENTWORTH, C. K., 1930, SAND AND GRAVEL RESOURCES OF THE COASTAL PLAIN PROVINCE OF VIRGINIA: VIRGINIA GEOL. SURVEY BULL. 32.

WHITE, W. A., 1958,,SOME GEOMORPHIC FEATURES OF CENTRAL PENINSULAR FLORIDA: FLORIDA GEOL. SURVEY, BULL. 41.

Fig. 1. Approximate position of holes drilled and sampled to May 1962 and general surface topography of the region between Orangeburg and Summerville, South Carolina.



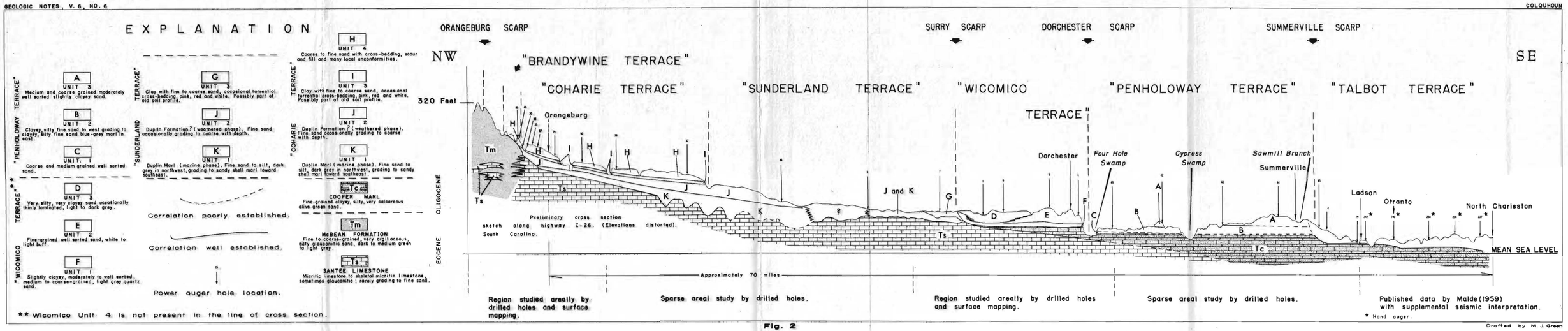
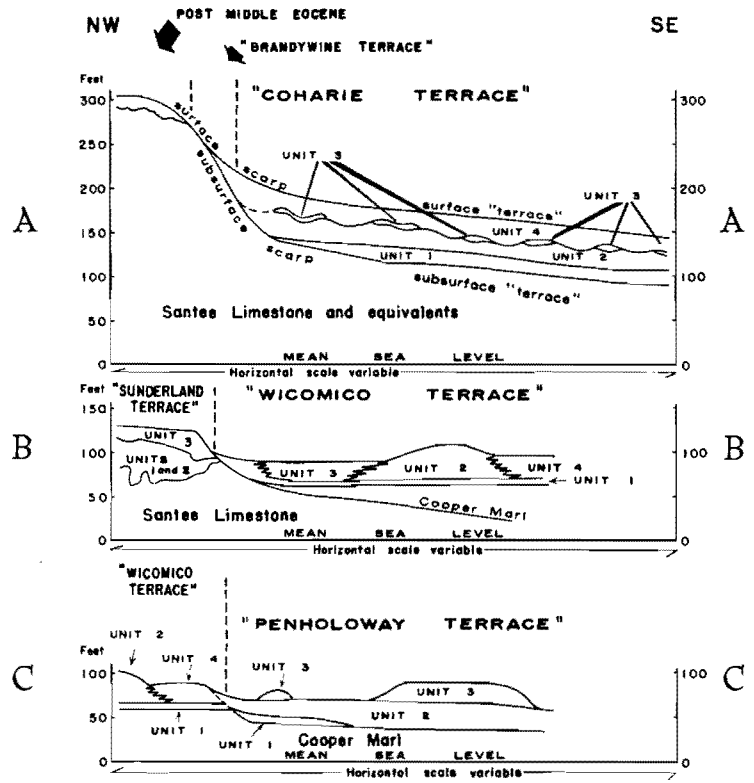


Fig. 2

Drafted by M. J. Green



A Hypothetical cross section through the "Orangeburg Scarp". Central South Carolina.

B Hypothetical cross section through the Surry Scarp. South Carolina.

C Hypothetical cross section through the "Dorchester Scarp". South Carolina.

Figure 3.